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I, JANENE PEISKER, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2004901661 for a patent by GORDON SERVICES PTY LTD as filed on 30 March 2004.

WITNESS my hand this  
Seventh day of April 2005

JANENE PEISKER  
TEAM LEADER EXAMINATION  
SUPPORT AND SALES



1

**AUSTRALIA****PATENTS ACT 1990****PROVISIONAL SPECIFICATION**

for the invention entitled:

**“ Water Treatment ”**

The invention is described in the following statement:

## WATER TREATMENT

### 5 Field of the Invention

This invention relates to water treatment processes and devices. In specific non-limiting aspects it relates to methods of treating grey water and lightly polluted stormwater, cartridges for treating grey water and grey water treatment assemblies.

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### Background of the Invention

Human use of water resources has been increasing in response to increasing human population, agriculture and industrialization. However, the amount of fresh water 15 available for use from rivers, lakes and subterranean basins is a comparatively limited amount on a worldwide basis. Clearly the world population cannot go on increasing indefinitely without putting impossible strains on the current sources of fresh water.

In order to alleviate water shortages, authorities are increasingly relying upon using 20 treated recycled water otherwise known as grey water for all sorts of purposes, particularly where a high quality water resource is not required. Such is the case for watering of lawns and gardens. Where public authorities are involved in recycling of water, there needs to be a substantial infrastructure for piping grey water from consumers to a recycling plant and then to an area where it can be used profitably. 25 Whilst this might be a suitable approach for large public or commercial operations, approaches for recycling grey water on a domestic basis for use within a household where the grey water has been generated, are not generally practical. This is due to the lack of readily available domestic grey water treatment systems, the space they occupy and the high cost of installing and maintaining such systems.

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Thus, there is a need for an approach for water treatment which may be particularly applicable to grey water and which may be useful in a domestic recycling environment.

5 Suitably, the approach should involve equipment which does not require substantial maintenance, does not have a large footprint, is easy to operate and is relatively inexpensive.

10 The present invention seeks to provide a method and devices which go some way towards meeting one or more of these objectives.

#### Disclosure of the Invention

The invention provides in one aspect a method of treating water which comprises,  
15 forming a mixture of a particulate natural organic substrate with a flow control component, and  
causing the water to trickle through a column of the mixture whilst allowing oxygen containing gas to permeate the mixture,  
wherein the particulate natural organic substrate is adapted to support aerobic  
20 bacteria and the flow control component is adapted to create a plurality of sinuous pathways for the water trickling through the column whilst facilitating permeation of the gas through the column.

25 The particulate natural organic substrate may comprise peat, moss, sphagnum moss, compost, lichen, straw, hay, mulch, pulp, rice husks, wheat husks or mixtures of any two or more of the foregoing.

In a particular aspect of the invention, the particulate natural organic substrate may comprise peat.

30 The flow control component may comprise a particulate material which is distributed throughout the column. For example, it may comprise particulate or shredded

organic or inorganic material. It may comprise shredded plastic. It may comprise shredded plastic mesh.

5 Additionally or alternatively, the flow control component may comprise one or more tiers of impermeable material arranged throughout the column.

10 The column may include inflow means for allowing an oxygen containing gas such as air to percolate through the column. Suitably, the inflow means may allow the air to percolate upwards through the column whilst allowing water to percolate down through the column. The inflow means may comprise a perforated or porous tube extending into the column. Alternatively or additionally the inflow means may comprise a porous container for holding the column.

15 In another aspect, the invention provides a cartridge comprising a column as hereinbefore described housed within a cover comprising a geotextile and/or similar fabric material. Thus, the air inflow means may extend through the geotextile into the column in the form of a perforated tube and may also comprise the geotextile which is itself porous.

20 The column may include secondary distribution means for the water being treated in the column. The secondary distribution means may comprise a funnel which directs water to a position intermediate the height of the column. There may be a plurality of such funnels. The one or more funnels may extend from a position at the top of the column into a region substantially at the midpoint of the height of the column.

25 Alternatively, they may be arranged so as to deliver the water for treatment at a number of equally spaced heights in the column. Thus for example, water may be arranged to percolate directly into the top of the column whilst a proportion of the water may be directed into the top third of the column by one or more funnels and to a bottom third of the column by one or more additional funnels.

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In another aspect the invention provides a grey water treatment assembly comprising, a collection reservoir for grey water,

a treatment module comprising a column as hereinbefore described,  
a delivery system for feeding the grey water from the collection reservoir to  
flow through the treatment module, and  
5 a storage reservoir arranged to receive treated grey water after it has passed  
through the treatment module.

The treatment assembly may comprise several treatment modules. The treatment  
modules may be removable retained within a treatment tank. Thus, the treatment tank  
may include one or more cartridge casings for receiving the cartridges and an equal  
10 number of showerheads for directing water for treatment into the top of the columns  
and any funnels provided at the top of the column. The casings may include a spigot  
for fitting into a tube formed at the bottom of each treatment module to allow oxygen  
containing gas such as air to permeate upwards through the cartridge.  
15 Preferred aspects of the invention will now be described with reference to the  
accompanying drawings.

#### **Brief Description of the Drawings**

20 Figure 1 shows an elevational view of a vertical section taken through the  
centre of a cartridge according to the invention;  
Figure 2 shows a vertical section taken through a funnel for use with the  
cartridge;  
25 Figure 3 shows a vertical section taken through a treatment tank for use with  
the invention;  
Figure 4 shows the section A taken through the dispersion manifold shown in  
Figure 3;  
Figure 5 shows the section B taken through Figure 3;  
Figure 6 shows a concept drawing of the operation of the treatment tank shown  
30 in Figure 3; and  
Figure 7 shows a concept drawing of a treatment assembly according to the  
invention.

**Detailed Description of the Preferred Embodiments**

The various elements identified by numerals in the drawings are listed in the  
5 following integer list.

**Integer List**

	1	Cartridge
10	3	Outer wall
	4	Filling
	5	Central tube
	7	Hole
	9	Flange
15	10	Fuse joint/mechanical joint
	11	Distributor funnel
	12	Location point
	13	Treatment tank
	15	Outer casing
20	16	Dispersion manifold
	17	Cartridge casing
	20	Inlet tube
	22	Holes
	24	Shower head
25	25	Shower holes
	26	Seal
	27	Spigot member
	29	Outlet
	30	Open region
30	31	Air passage
	32	Air inlet
	33	Motor

- 34 Air outlet
- 40 Inlet pipe
- 42 J tube
- 43 Valve
- 5 46 Collection reservoir
- 48 Vent
- 49 Vent/overflow valve
- 51 Removable sealing cap
- 52 Valve
- 10 53 Power source (solar)
- 54 Pump
- 55 Motor
- 56 Variable speed drive
- 57 Timer
- 15 58 Flowsswitch
- 61 Coarse strainer
- 63 Outlet line
- 65 Storage reservoir
- 66 Overflow line
- 20 67 Valve
- 68 Reuse line
- 69 Valve
- 70 Valve
- 71 Recycle line
- 25 74 Valve

Referring to Figure 1, the cartridge generally designated 1 shown therein comprises an outer wall 3 of a gas permeable material such as geotextile fabric.

- 30 The geotextile fabric holds the filling 4 which comprises the treatment agent used in the cartridge. The filling may typically comprise a natural organic particulate

material which acts as a substrate for aerobic bacteria. It has been found that peat can be quite effective as an organic substrate for aerobic and anaerobic bacteria.

Mixed with the particulate peat forming the filling is a material which tends to bulk up the peat and create sinuous pathways through the peat for water trickling through the peat whilst at the same time leaving the filling material sufficiently porous to allow air to percolate upwards through the peat. Particulate shredded plastics mesh material has been found to be very suitable for this purpose.

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15 In addition to the effect achieved by the shredded mesh, the cartridge is provided with a number of flanges 9 surrounding a central tube 5. These flanges also help to divert water flowing down through the cartridge and air percolating upwards from what might otherwise be relatively straight flow paths. They are formed around the central tube 5. They are designed to allow air to travel up through the tube and to pass through a number of holes 7 formed along the length of the tube into the filling in the cartridge.

20 One or more distributor funnels 11 shown in Figure 2 may be pushed through the geotextile material at location points 12 on the top of the geotextile material. The distributor funnel or funnels may be added so as to direct a proportion of water flowing onto the top of the cartridge into an intermediate position in the height of the filling in the cartridge. It has been found that use of funnels in this fashion can improve the efficiency of water treatment by the cartridge depending of course upon the height of the treatment cartridge used.

25 The geotextile material forming the outer wall 3 of the cartridge may be joined to the lowermost flange 9 surrounding the central tube 5 by a circular fuse joint or mechanical joint 10. This holds the central tube within the outer wall gives a degree of structural rigidity to the cartridge when it has been filled with filling 4.

30 Referring to Figures 3 to 5, there is shown a treatment tank generally designated 13 which is set up so that it can removably receive three separate cartridges, the

cartridges being individually replaceable as and when they have reached the limit of their useful effective life.

5 The treatment tank 13 comprises an outer casing 15 formed of a material such as plastics, particularly rotationally moulded plastic. It has a dispersion manifold 16 which acts as lid to seal off the top of the outer casing.

Three cartridge casings 17 are arranged within the outer casing.

10 These cartridge casings 17 are each formed with a spigot member 27 adapted to co-operate with the central tube 5 of each cartridge so as to provide an entry point for air to the central tube and to correctly locate the cartridge within the cartridge casing.

15 The outer casing 15 has an air inlet 32 which may optionally include a motor 33 for operating a fan to drive air through the inlet. The air inlet communicates with the open region 30 formed between the base of the cartridge casing 17 and the bottom of the outer casing 15 to allow air to travel through the spigot 27 and air passage 31.

20 The dispersion manifold 16 includes a seal 26 for sealing off the top of the outer casing.

An inlet tube 20 for delivering grey water extends through the centre of the dispersion manifold and includes a number of holes 22 for allowing grey water to flow down into the showerheads 24 formed at the bottom of the dispersion manifold. A number 25 of shower holes 25 are arranged to evenly distribute grey water to the top of the cartridges 1 and any funnels held in the cartridge casing 17.

Each of the cartridge casings has an outlet 29 for allowing treated water which has passed through a cartridge to be drawn from the treatment tank. Similarly, an air 30 outlet 34 is provided at the top of the outer casing 15 to allow air which has percolated through the cartridge casing to exhaust from the treatment tank.

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Referring to Figure 6, it can be seen that the general arrangement of cartridges within the treatment tank allows grey water to enter each of the cartridges via the holes 22 in the showerhead and to trickle down through the cartridges in a circuitous path. The shredded mesh material forming part of the filling for the cartridge and the flanges 9 contribute to ensuring that the flow of water through the cartridge is circuitous.

Whilst the water is flowing downwardly, air from the central tube 5 and through the porous walls of the cartridge 3 permeates upwardly through the cartridge creating aerobic conditions for bacteria held on and within the peat in the filling. The aerobic bacteria digest unwanted components of the grey water and hence purify and deodorize it.

The treatment assembly of Figure 6 may be used to treat grey water from one or more domestic sources. It includes a treatment tank 13 as described with reference to Figures 3 to 6, and an inlet pipe 40 connected via a J-tube 42 and valve 43 to a collection reservoir 46. A vent 48 and vent overflow valve 49 are connected to the inlet pipe for grey water as is known in the art. A removable sealing cap 51 is also provided on a separate extension of the inlet pipe 40.

The collection reservoir 46 is arranged to direct grey water collected from a household or any other source as and when needed through the inlet tube 20 and valve 52 by means of a pump 54 driven via a motor 55 having a variable speed drive 56. A power source 59 such as a solar collector provides power for the pump and a timer 57 can be used to set appropriate times for when the motor should operate.

As a precaution, a flowswitch 58 may be provided to sense flow through the inlet tube 20 and to shut off the motor when flow from the reservoir 46 stops as a result of the reservoir being empty.

A coarse strainer 61 is provided to strain off coarse materials from the grey water before it enters the treatment tank 13.

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A valve 74 is associated with the outlet 29 of each cartridge casing to allow testing of treated water which has passed through the cartridge. The cartridges 1 may be replaced individually as and when testing shows the water quality exiting the cartridge has gone below a predetermined level.

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The combined output of water from the cartridges passes through valve 69 to the outlet line 63 and on to a storage reservoir 65 for the treated water.

An overflow line 66 sends excess water to waste when the storage reservoir has been 10 filled to capacity.

Water can be drawn from the storage reservoir 65 as and when needed through the reuse line 68 after it passes through the valve 67.

15 The treatment assembly may include the option of recycling water to the collection reservoir 46 should the quality of the water exiting the treatment tank not be at a desired level. Thus the system may include a recycle line 71 through valve 70 to return water to the reservoir 46 ie. when valve 69 is closed and valve 70 is opened, water will return directly to the reservoir 46. Alternatively, when valve 70 is closed 20 and valve 69 is opened, treatment water will go directly to the storage reservoir 65 or the overflow line 66 as the case may be.

Whilst the above description includes the preferred embodiments of the invention, it is to be understood that many variations, alterations, modifications and/or additions 25 may be introduced into the constructions and arrangements of parts previously described without departing from the essential features or the spirit or ambit of the invention.

It will be also understood that where the word "comprise", and variations such as 30 "comprises" and "comprising", are used in this specification, unless the context requires otherwise such use is intended to imply the inclusion of a stated feature or features but is not to be taken as excluding the presence of other feature or features.

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The reference to any prior art in this specification is not, and should not be taken as, an acknowledgment or any form of suggestion that such prior art forms part of the common general knowledge in Australia.

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Dated this 30th day of March 2004

10 **Gordon Services Pty Ltd**  
by their patent attorneys Morcom Pernat

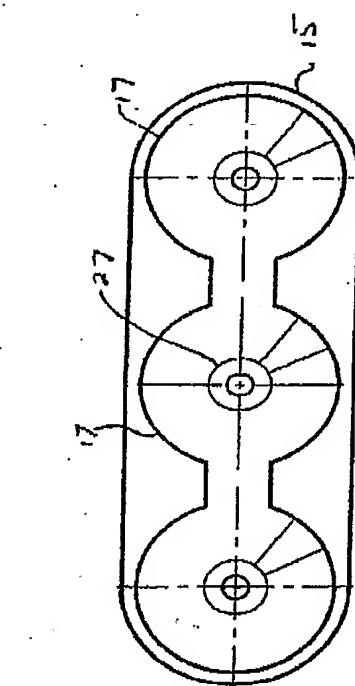


Fig. 5

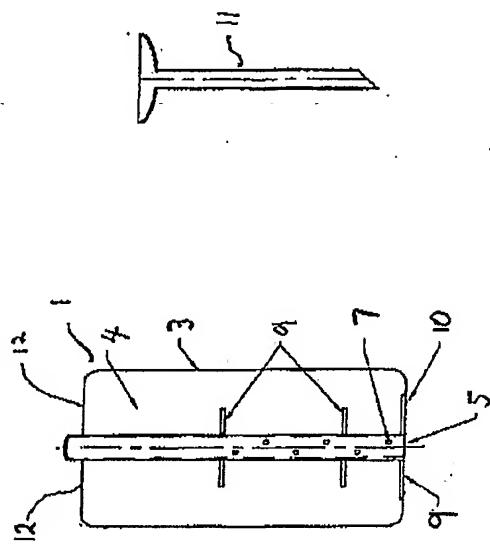


Fig. 1



Fig. 2

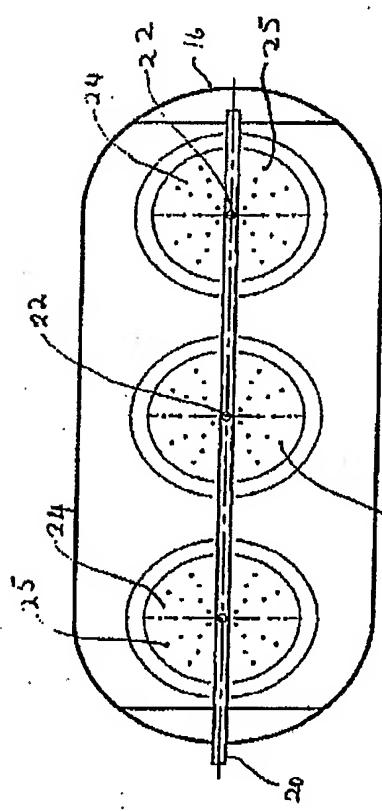


Fig. 4

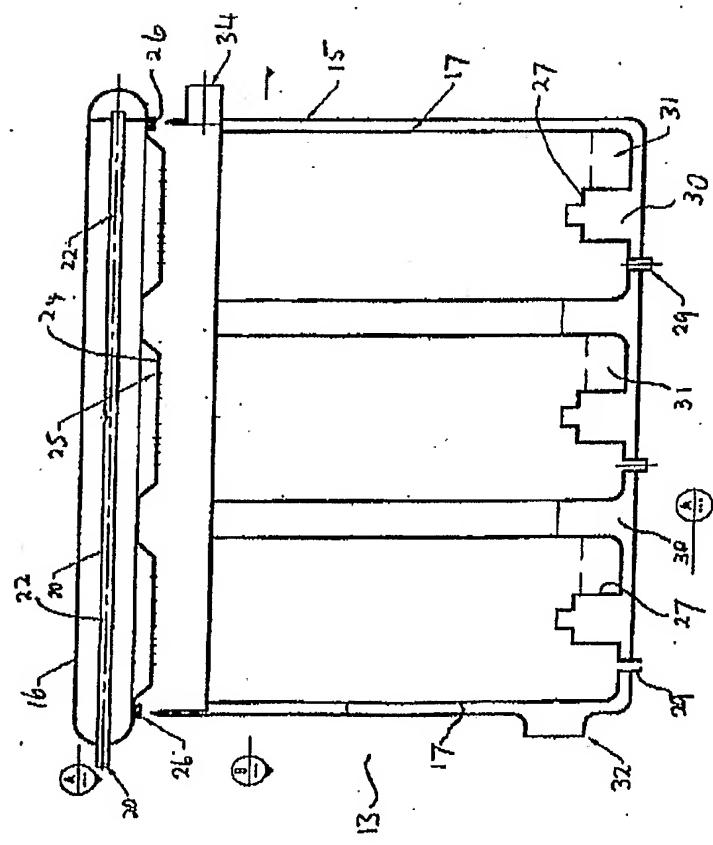


Fig. 3

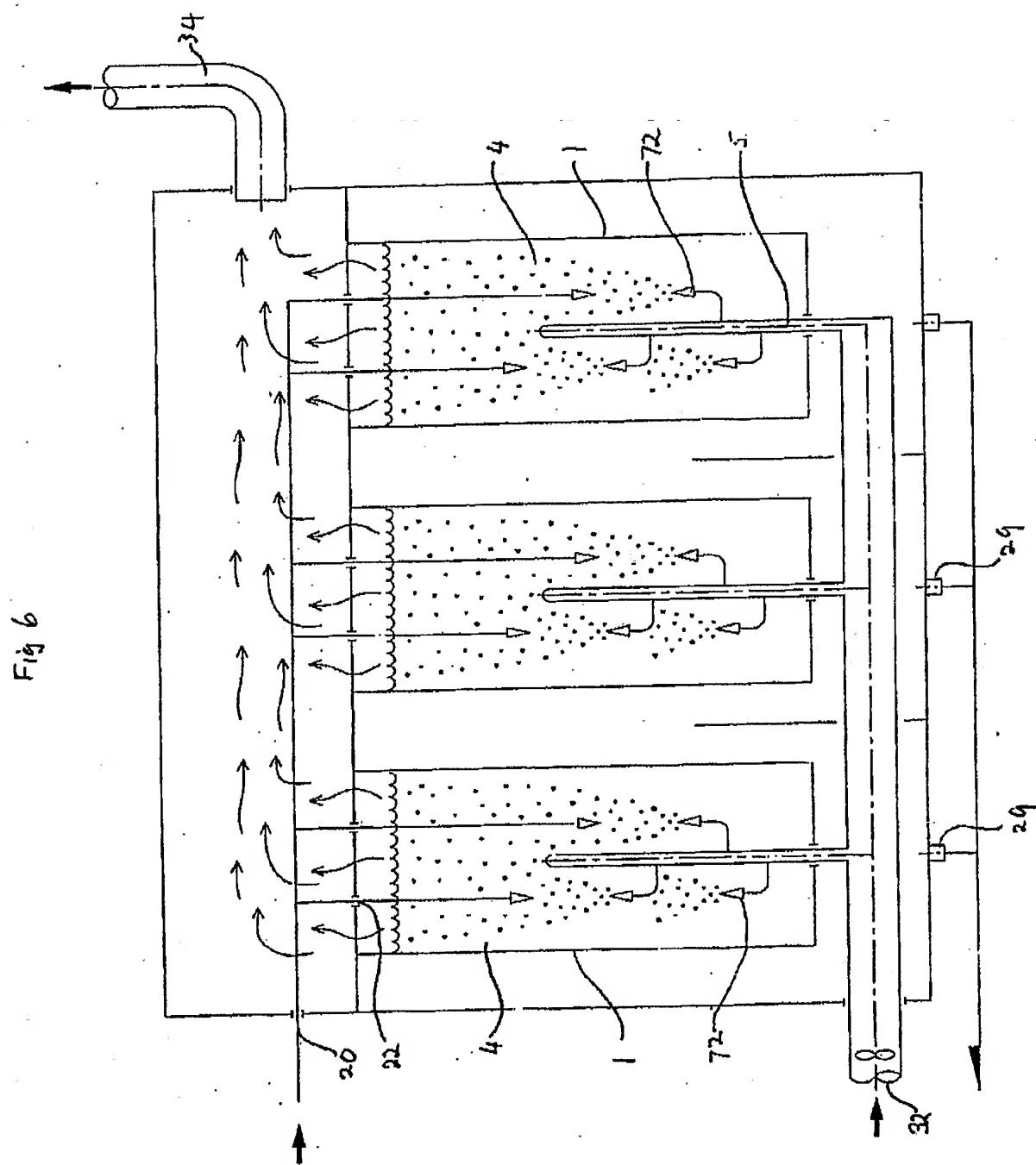


Fig 7

